CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1. A method of preparing a nanostructure, comprising the step of forming a nanowire under thermal conditions and under non-catalytic conditions.

2. The method of claim 1, wherein the step of forming the nanowire under thermal conditions comprises the step of forming a nanowire in the temperature range of about 800 °C to about 1500 °C.

3. The method of claim 1, wherein the step of forming the nanowire comprises the step of forming a metal nanowire.

4. The method of claim 3, wherein the step of forming the metal nanowire, comprises the step of forming a metal nanowire, wherein the metal is selected from the group consisting of: tin, chromium, iron, nickel, silver, titanium, cobalt, zinc, platinum, palladium, osmium, gold, lead, iridium, molybdenum, vanadium, and aluminum.

5. The method of claim 3, wherein the step of forming the metal nanowire, comprises the step of forming a metal oxide nanowire, wherein the metal oxide is selected from the group consisting of: tin dioxide, chromia, iron oxide, nickel oxide, silver oxide, titanium oxide, cobalt oxide, zinc oxide, platinum oxide, palladium oxide, vanadium oxide, molybdenum oxide, and lead oxide.

6. The method of claim 1, wherein the step of forming the nanowire comprises the step of forming a metalloid nanowire.

7. The method of claim 6, wherein the step of forming the metalloid nanowire, comprises the step of forming a silicon dioxide sheathed crystalline silicon nanowire, where the axis of the crystalline silicon nanowire core is substantially parallel to a ⟨111⟩ plane and substantially free of defects.

8. The method of claim 7, wherein the step of forming the silicon dioxide sheathed silicon nanowire that is substantially free of defects further comprises the step of forming a silicon dioxide sheathed silicon nanowire that is substantially free of twinning, substantially free of high order grain boundaries, and substantially free of stacking faults.

9. A method of preparing a nanostructure, comprising the step of forming a plurality of substantially monodisperse nanospheres.

10. The method of claim 9, wherein the step of forming the plurality of nanospheres comprises the step of forming a plurality of substantially monodisperse metal nanospheres.

11. The method of claim 10, wherein the step of forming the metal nanosphere, comprises the step of forming the metal nanosphere where the metal is selected from the group consisting of: tin, chromium, iron, nickel, silver, titanium, cobalt, zinc, platinum, palladium, osmium, gold, lead, iridium, molybdenum, vanadium, and aluminum.

12. The method of claim 9, wherein the step of forming the plurality of nanospheres, comprises the step of forming a plurality of substantially monodisperse metal oxide nanospheres.

13. The method of claim 12, wherein the step of forming the metal oxide nanospheres comprises the step of forming a metal oxide nanospheres, wherein the metal oxide is selected from the group consisting of: tin dioxide, chromia, iron oxide, nickel oxide, silver oxide, titanium oxide, cobalt oxide, zinc oxide, platinum oxide, palladium oxide, vanadium oxide, molybdenum oxide, and lead oxide.

14. The method of claim 12, wherein the step of forming the plurality of substantially monodisperse metal oxide nanospheres, includes the step of forming a plurality of substantially disperse tin dioxide nanospheres.

15. The method of claim 9, wherein the step of forming the plurality of nanospheres, includes the step of forming a plurality of substantially monodisperse metalloid oxide nanospheres.

16. The method of claim 15, wherein the step of forming the plurality of substantially monodisperse metalloid oxide nanospheres, includes a step of forming a plurality of substantially monodisperse metalloid oxide nanospheres, wherein the metalloid oxide is silicon dioxide.

17. The method of claim 16, wherein the step of forming the plurality of substantially monodisperse metalloid oxide nanospheres, wherein the metalloid oxide is silicon dioxide comprises the step of forming an amorphous silicon dioxide nanosphere.

18. The method of claim 16, wherein the step of forming the plurality of substantially monodisperse metalloid oxide nanospheres, wherein the metalloid oxide is silicon dioxide comprises the step of forming a plurality of substantially disperse metalloid oxide nanospheres with a diameter range of about 8 nanometers to about 45 nanometers.

19. The method of claim 9, wherein the step of forming the nanosphere, further comprises the step of forming a nanosphere under thermal conditions.

20. The method of claim 9, wherein the step of forming a nanosphere, further includes the step of forming a nanosphere under non-catalytic conditions.

21. A method of fabricating catalytic nanostructures, comprising the step of metallizing a nanosphere.

22. The method of claim 21, wherein the step of metallizing the nanosphere, includes the step of producing at least a gram of nanospheres.

23. The method of claim 21, wherein the step of metallizing the nanosphere, includes the step of metallizing a metal nanosphere.

24. The method of claim 22, wherein the step of metallizing the metal nanosphere, includes the step of metallizing a metal nanosphere, wherein the metal is selected from the group consisting of: tin, chromium, iron, nickel, silver, titanium, cobalt, zinc, platinum, palladium, osmium, gold, lead, iridium, molybdenum, vanadium, and aluminum.

25. The method of claim 21, wherein the step of metallizing the nanosphere, includes the step of metallizing a metalloid oxide nanosphere, wherein the metalloid oxide is silicon dioxide.

26. The method of claim 21, wherein the step of metallizing the nanosphere, includes the step of metallizing a metal oxide nanosphere.

27. The method of claim 12, wherein the step of metallizing the metal oxide nanosphere, includes the step of metallizing a metal oxide nanosphere, wherein the metal oxide is selected from the group consisting of: tin dioxide, tin dioxide, chromia, iron oxide, nickel oxide, silver oxide, titanium oxide, cobalt oxide, zinc oxide, platinum oxide, palladium oxide, vanadium oxide, molybdenum oxide, and lead oxide.

28. The method of claim 26, wherein the step of metallizing the metal oxide nanosphere, includes the step of metallizing a metal oxide nanosphere, wherein the metal oxide is tin dioxide.

29. The method of claim 21, wherein the step of metallizing the nanosphere, includes metallizing a nanosphere with a second metal.

30. The method of claim 26, wherein the step of metallizing the nanosphere with the second metal, includes the step of metallizing a nanosphere with a second metal selected from the group consisting of: copper, tin, and aluminum.

31. A nanostructure, comprising a metal nanowire.

32. The nanostructure of claim 31, wherein the metal nanowire comprises a metal wherein the metal is selected from the group consisting of: chromium, iron, nickel, silver, titanium, cobalt, zinc, platinum, palladium, osmium, gold, lead, iridium, molybdenum, vanadium, and aluminum.

33. The nanostructure of claim 31, wherein the metal nanowire comprises a metal oxide nanowire, wherein the metal oxide is selected from the group consisting of: tin dioxide, chromia, iron oxide nickel oxide, silver oxide, titanium oxide, cobalt oxide, zinc oxide, platinum oxide, palladium oxide, vanadium oxide, molybdenum oxide, lead oxide.

34. The nanostructure of claim 33, wherein the metal oxide nanowire is a tin dioxide nanowire.

35. A nanostructure, comprising a metalloid nanowire.

36. The nanostructure of claim 35, wherein the metalloid nanowire includes a silicon dioxide sheathed crystalline silicon nanowire, where the axis of the crystalline silicon nanowire core is substantially parallel to a ⟨111⟩ plane and substantially free of defects.

37. A nanostructure, comprising a metal nanosphere.

38. The nanostructure of claim 37, including a plurality of substantially monodisperse metal nanospheres.

39. The nanostructure of claim 37, wherein the metal is selected from the group consisting of: chromium, iron, nickel, silver, titanium, cobalt, zinc, platinum, palladium, osmium, gold, lead, iridium, molybdenum, vanadium, and aluminum.

40. The nanostructure of claim 37, wherein the metal nanosphere includes a metal oxide nanosphere, wherein the metal oxide is selected from the group consisting of: tin dioxide, chromia, iron oxide, nickel oxide, silver oxide, titanium oxide, cobalt oxide, zinc oxide, platinum oxide, palladium oxide, vanadium oxide, molybdenum oxide, and lead oxide.

41. The nanostructure of claim 40, wherein the metal nanosphere is a tin dioxide nanosphere.

42. A nanostructure, comprising silicon dioxide nanosphere.

43. The nanostructure of claim 42, wherein the silicon dioxide nanosphere has a diameter from about 8 to about 45 nanometers.

44. The nanostructure of claim 42, wherein the silicon dioxide nanosphere is metallized with 3 weight percent copper.

45. A method of metallizing a nanostructure, comprising the steps of:

forming a nanosphere;

metallizing the nanosphere with a metal; and

forming a metallized nanosphere that has been metallized with the metal.

46. The method of claim 45, wherein the step of metallizing the nanosphere with the metal, includes metallizing a nanosphere with copper.

47. The method of claim 45, wherein the step of forming the metallized nanosphere, includes the step of forming a metallized copper nanosphere that has been metallized with about 3 weight percent copper.

48. The method of claim 45, wherein the step of metallizing the nanosphere with a metal, includes the step of metallizing a nanosphere with a metal selected from the group consisting of: copper, tin, aluminum, silver, platinum, palladium, iron, cobalt, and nickel.

49. The method of claim 45, wherein the step of forming the metallized nanosphere, includes the step of forming a metallized metal nanosphere, wherein the metal is selected from the group consisting of: copper, tin, aluminum, silver, platinum, palladium, iron, cobalt, and nickel.

50. The method of claim 45, wherein forming the nanosphere includes the step of forming a nanosphere under thermal conditions.

51. The method of claim 50, wherein the step of forming the nanowire under thermal conditions comprises the step of forming a nanowire in the temperature range of about 800 °C to about 1500 °C.

52. The method of claim 45, wherein forming the nanosphere includes the step of forming a nanosphere under non-catalytic conditions.

53. A method of dehydrogenating ethanol, comprising the steps of:

introducing gaseous ethanol to 3 weight percent copper metallized silicon dioxide nanosphere; and

producing at least 6 percent conversion/mg copper for the selective dehydrogenation of ethanol to acetaldehyde.